International Geoscience and Remote Sensing Symposium (IGARSS)
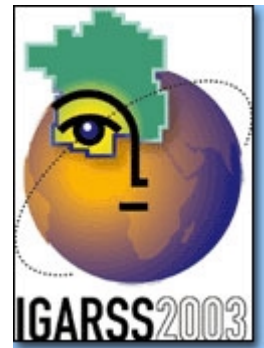21-25 July, 2003   Toulouse, France

This year's theme was Learning Earth's Shapes and Colors. 149 topics were arranged into 7 sections, including:

- Applications of Remote Sensing
- Mission and Programs
- Geoscience, Modeling, & Processing
- Data Processing & Algorithms
- Electromagnetic Problems
- Instrumentation & Techniques
- Policy, Societal Issues, & Education Initiatives

The Future Global Earth Observing System: System requirements and architecture

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ABSTRACT: This paper summarizes the observational requirements for a future Earth System Observational and Modeling capability, in terms of the observed variables, the needed precision, and spatial-temporal resolution. Architectural approaches are discussed, including an open-systems, evolutionary, sensor-web approach.

I. Introduction

The Earth environmental system—the interconnected oceans and atmosphere, the biosphere, the solid Earth—influences all aspects of life on the planet. The Earth's comfortable environment, with its moderate temperatures and relatively abundant fresh water, has provided for the development of the remarkable and diverse forms of life we find on Earth.

The natural variability of the Earth's environment links to life in a myriad of ways, affecting human activities, the availability of water, the production of food, atmospheric composition, ecosystem and human health, and even human migration. As the human population grows, the links between the ever-changing Earth environment, human needs, and environmental impacts also grow. As our society grows and demands more of the Earth, the capability for quantitative prediction of the Earth system is becoming more and more important. In the decades to come we must move beyond the basic understandings of the components of the Earth system, to develop an accurate and quantitative predictive capability for the Earth system as a whole. We must develop the ability to understand and to accurately predict future changes of Earth's atmosphere, oceans, biosphere and solid Earth. These predictions will enable informed societal decisions that will enhance the quality of life, economic sustainability, and global social stability.

During the past 20 years Earth science research has focused on understanding the components of the Earth system. This has been accomplished through new global observations and computer models that address specific Earth system processes.

The circa 2030 future Earth System Observational and Modeling capabilities will extend beyond the present weather, ocean, land surface, and biosphere observations to include comprehensive Earth observation. This will include a global perspective of the ocean and atmospheric systems, their states, processes, heat transport, and evolution, and the coupling between ocean and atmosphere, and understanding of the complex linkages between climate and the water cycle. It will include a global perspective of the solid Earth, crustal movement and processes, ice processes and sea level, Earth inner circulations, and the linkages between solid Earth processes, climate and the water cycle. It will include a global perspective of the biosphere and ecosystem health, and their linkages to ocean-atmosphere, climate and the water cycle. These aspects of the Earth system will require routine global observations, all made with appropriate precision and with the required temporal and spatial resolution.

These complex observations will be achieved through a mixture of remote sensing and direct measurements, ingested into data assimilation models which can evaluate their precision and timeliness, placing appropriate weight to their application to the Earth system model. The model will, itself, be a composite of components that address each aspect of the Earth system, and the linkages between components.

This paper summarizes the future Earth system observational requirements in terms of the science needs for observed variables, the needed precision, and the spatial-temporal resolution. Since implementation of these observational capabilities will be a complex international effort, it will be important to develop architectural approaches that enable an evolutionary, open-systems approach to the total Earth observational system. We will discuss our view of the observational requirements and some possible approaches to developing an acceptable, international system architecture.